

# Tectonics and Mineral Resources of Southwestern North America

*A Volume Honoring*  
VINCENT C. KELLEY

*Editors*

LEE A. WOODWARD  
STUART A. NORTHROP

NEW MEXICO GEOLOGICAL SOCIETY  
SPECIAL PUBLICATION NO. 6

1976

# CONTENTS

Foreword .....	Lee A. Woodward and Stuart A. Northrop	
Vincent C. Kelley .....		1
Plate Tectonics and the Laramide Orogeny .....	<i>Peter J. Coney</i>	5
Laramide Deformation of Rocky Mountain Foreland: Geometry and Mechanics .....	<i>Lee A. Woodward</i>	11
Mexico—Geotectonics and Mineral Deposits .....	<i>Zoltan de Cserna</i>	18
Geologic Section across Sierra Madre Occidental, Chihuahua to Topolobampo, Mexico.....	<i>K.F. Clark</i>	26
Tectonics of the Northern and Eastern Parts of the Otero Platform, Otero and Chaves Counties, New Mexico.....	<i>Bruce A. Black</i>	39
Structural Geology of the Rio Puerco Fault Zone and its Relationship to Central New Mexico Tectonics .....	<i>Paul B. Slack and Jock A. Campbell</i>	46
Kinematics of Tertiary and Quaternary Deformation along the Eastern Edge of the Lucero Uplift, Central New Mexico .....	<i>J. F. Callender and R. E. Zilinski</i>	53
Aeromagnetic and Gravity Studies of the Rio Grande Graben in New Mexico between Belen and Pilar .....	<i>Lindrith Cordell</i>	62
Deep Resistivity Investigations at Two Known Geothermal Resource Areas (KGRAs) in New Mexico: Radium Springs and Lightning Dock .....	<i>George R. Jiracek and Christian Smith</i>	71
New Mexico's Earthquake History, 1849-1975 .....	<i>Stuart A. Northrop</i>	77
Shale Diapirism and the Structural Development of Galisteo Syncline, Santa Fe County, New Mexico .....	<i>Alvis L. Lisenbee</i>	88
Stratigraphy and Structure of the Acoma Region, New Mexico .....	<i>Charles H. Maxwell</i>	95
Paleontology and Stratigraphy of the Red Tanks Member, Madera Formation (Pennsylvanian) near Lucero Mesa, New Mexico .....	<i>Barry S. Kues and Kenneth K. Kietzke</i>	102
Maare and Tuff Rings of New Mexico .....	<i>J. C. Aubele, L. S. Crumpler, K. N. Loeber, and A. M. Kudo</i>	109
Sierra de Las Uvas Ash-Flow Field, South-Central New Mexico .....	<i>Russell E. Clemons</i>	115
Tectonic and Igneous Effects on Petroleum Accumulations in Southwestern New Mexico .....	<i>Sam Thompson III</i>	122
Precambrian Mineralization in the Southern Rocky Mountain Region .....	<i>David L. Giles</i>	127
Geologic, Geochemical, and Geochronologic Investigation of Precambrian Metamorphic Rocks of the Las Tablas-La Madera Quadrangles and the Picuris Range, Northern New Mexico—A Summary .....	<i>Randall L. Gresens</i>	132
Uranium Resources of New Mexico .....	<i>William L. Chenoweth</i>	138
Systematic Distribution of Large Uranium Deposits in the Grants Uranium Region, New Mexico .....	<i>James W. Melvin</i>	144
Tectonic Influence on Uraniferous Trends in the Late Jurassic Morrison Formation .....	<i>A.E. Saucier</i>	151

The Grants Mineral Belt, New Mexico: Comments on the Coffinite-Uraninite Relationship, Probable Clay Mineral Reactions, and Pyrite Formation .....	Douglas G. Brookins 158
Structural Studies of the Big Bug Pluton, Yavapai County, Arizona: Implications for Fracture Control in the Porphyry Copper Environment .....	James A. Sturdevant 167
Geology and Exotic Copper Mineralization in the Vicinity of Copper Butte, Pinal County, Arizona .....	<i>C.H. Phillips</i> 174
Resurgent Cauldrons and Associated Mineralization, Trans-Pecos Texas .....	Noel McAnulty 180
Zoning and Paragenesis of Ores in the San Pedro Mountains, Santa Fe County, New Mexico .....	William W. Atkinson, Jr. 187
Geology of the Down-Dropped Block, Leadville District, Colorado .....	<i>Tommy B. Thompson</i> 192
Crystallization of a Soda Granite, Treasure Mountain Dome, Colorado, and the Genesis of Stockwork Molybdenite Deposits .....	Felix E. Mutschler 199
Origin and History of a Meteorite Parent-Body Regolith Breccia: Carbonaceous and Noncarbonaceous Lithic Fragments in the Abbott, New Mexico, Chondrite .....	<i>R. V. Fodor, K. Keil, L. L. Wilkening, D. D. Bogard, and E. K. Gibson</i> 206

## FOREWORD

This volume consists of articles contributed by the former students and colleagues of Vincent C. Kelley at the University of New Mexico. The title "Tectonics and mineral resources of southwestern North America" is not intended to imply a comprehensive coverage of these topics, but rather to reflect the interests of Professor Kelley and his students.

A glance at the table of contents reveals several articles that clearly do not concern tectonics nor mineral resources; these papers are authored by Kelley's colleagues and indicate the scope of the scientific activities at the institution that he has been associated with for nearly 40 years.

His efforts and contributions have been instrumental in the growth and development of the Department of Geology at the University of New Mexico. Those of us who have had the opportunity to work and study with Vincent Kelley have profited immensely from that association. It is fitting that the New Mexico Geological Society should publish these articles honoring Vincent Kelley, as he was one of the founders of the Society and has been deeply involved in many of the field conferences sponsored by the NMGS.

Publication of this volume is made possible by grants from Amoco Foundation, Atlantic Richfield Company, Aztec Oil and Gas Company, Cities Service Foundation, and Tenneco Foundation. Their generous contributions partially defrayed the printing costs.

Lee A. Woodward  
Stuart A. Northrop



Vincent C. Kelley